REMARKS

Applicants amend the claims to remove multiple dependencies, to provide proper antecedent basis, and to address other matters of form. The foregoing amendments introduce no new matter and are not related to issues of patentability.

Entry of the foregoing Preliminary Amendment is respectfully in order and requested.

If there are any questions regarding the amendments to the application, we invite the Examiner to call Applicant's representative at the telephone number below.

Respectfully submitted,

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Version With Markings To Show Changes Made

Please amend claims 4, 5, 8-11, 13, 14, 16, 17, 20-26, 28, 29, 33, 36, 39, 42, 50, 53, 55, 57, 58, 62, 65-67, 69-72, 77 and 78 as follows:

4. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the substrate comprises silicon and/or silica and/or sapphire.

5. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the substrate includes an intermediate layer~~.~~ including a buffer layer formed on the substrate, wherein said buffer layer comprises a thermally oxidised layer of the substrate.

8. A waveguide as claimed in Claim ~~6 or Claim 7~~ 5, wherein the intermediate layer further includes a lower cladding layer formed on said buffer layer.

9. A waveguide as claimed in ~~any of~~ Claim~~s~~ ~~6 to 8~~ 5, wherein the thickness of the buffer layer is in the range ~~5m~~ 5μm to ~~20m~~ 20μm.

10. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the second core layer is formed on the first core layer and said first core layer is formed on the substrate.

11. A waveguide as claimed in ~~any of~~ Claim~~s~~ 1~~ to 9~~, wherein the first core layer is formed on the second core layer and said second core layer is formed on the substrate.

13. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the first core layer includes silica.

14. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the first core layer dopant includes dopant ions~~.~~, including tin and/or cerium and/or sodium.

16. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the second core layer includes silica.

17. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the second core layer includes a phosphorus oxide.

20. A waveguide as claimed in ~~any of~~ Claim~~s~~ 16~~-to 19~~, wherein the second core layer dopant includes a rare earth and/or a heavy metal and/or compounds of these elements.

21. A waveguide as claimed in Claim ~~20~~ 16, wherein the second core layer dopant includes ~~rare earth is~~ Erbium or Neodymium.

22. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the refractive indices of the first core layer and the second core layer are substantially equal.

23. 18. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the refractive index of the waveguide core differs from that of the substrate by at least 0.05%.

24. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the thickness of the first core layer is in the range ~~0.2m~~ 0.2μm to ~~30m~~ 30μm.

25. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the thickness of the second core layer is in the range ~~0.2m~~ 0.2μm to ~~30m~~ 30μm.

26. A waveguide as claimed in Claim ~~24~~,19 wherein the width of the waveguide core lies in the range ~~0.4m~~ 0.4μm to ~~60m~~ 60μm.

28. A waveguide as claimed in ~~any preceding~~ claim 1, wherein the refractive index of the substrate and the refractive index of the upper cladding layer are substantially equal.

29. An optical waveguide according to ~~any of~~ Claims 1 ~~to 28~~, wherein the first core layer includes at least 17% wt germanium dopant.

33. A method as claimed in ~~any of~~ Claims 30 ~~to 32~~, wherein the formation of the substrate includes the formation of an intermediate layer formed on said substrate including the formation of a buffer layer which is formed by thermally oxidising the substrate.

36. A method as claimed in Claim ~~34 or Claim 35~~ 33, wherein the formation of the intermediate layer further includes the formation of a lower cladding layer formed on said buffer layer.

39. A method as claimed in ~~any of~~ Claims 30 ~~to 38~~, wherein the second core layer is formed on the first core layer and wherein the first core layer is formed on the substrate~~.~~, and wherein a further first core layer is formed on the second core layer such that the first core layer sandwiches the second core layer.

42. A method as claimed in ~~any of~~ Claims 30 ~~to 41~~, wherein the steps of forming any one of the substrate, first core layer, the second core layer, and the upper cladding layer comprise the steps of: depositing each layer; and

at least partially consolidating each layer.

50. A method as claimed in ~~any of~~ Claims 30 ~~to 49~~, wherein the concentration of the first core layer dopant is selectively controlled during the formation of the first core layer and the concentration of the second core layer dopant is selectively controlled during the formation of the second core layer so that the refractive index of the first core layer and the refractive index of the second core layer are substantially equal.

53. A method as claimed in ~~any of~~ Claims 42 ~~to 52~~, wherein at least one of the substrate, the first core layer, the second core layer, and the upper cladding layer is deposited by a Flame Hydrolysis Deposition process and/or Chemical Vapour Deposition process.

55. A method as claimed in ~~any of~~ Claim~~s~~ 42~~-to 54~~, wherein the consolidation is by fusing using a Flame Hydrolysis Deposition burner.

57. A method as claimed in Claim ~~55 or Claim 56~~ 54, wherein the step of fusing the lower cladding layer and the step of fusing the first core layer and/or the second core layer are performed simultaneously.

58. A method as claimed in ~~any of~~ Claim~~s~~ 30~~-to 57~~, wherein the waveguide core is formed from the first core layer and the second core layer using a dry etching technique and/or a photolithographic technique and/or a mechanical sawing process.

62. A laser waveguide with multiple core layers for transmitting an optical signal, the laser waveguide comprising a waveguide as claimed in ~~any of~~ claim~~s~~ 1 ~~to 29~~, the laser waveguide further comprising:

at least one grating formed in said waveguide core.

65. A laser waveguide as claimed in Claim 63~~-64~~, wherein the interference mirror is butt-coupled to or directly deposited at the input of the waveguide.

66. A laser waveguide as claimed in ~~any of~~ Claim~~s~~ 62~~-to 65~~, wherein the laser waveguide includes two mirrors and a grating.

67. A laser waveguide as claimed in ~~any of~~ Claim~~s~~ 62~~-to 65~~, wherein the laser waveguide includes one mirror and two gratings.

69. A laser waveguide as claimed in ~~any of~~ Claim~~s~~ 62~~-to 68~~,wherein the grating formed is a Bragg grating.

70. A laser waveguide as claimed in ~~any of~~ Claim~~s~~ 62~~-to 69~~, wherein said grating forms an output coupler for said laser waveguide.

71. A laser waveguide as claimed in ~~any of~~ Claim~~s~~ 62~~-to 70~~, further comprising an optical interference mirror butt coupled to or directly deposited at the output of the waveguide.

72. A method of fabricating a laser waveguide, comprising forming a waveguide according to a method as claimed in ~~any of~~ Claim~~s~~ 30 ~~to 61~~, the method of fabricating the laser waveguide further including the steps of:

forming at least one grating in said waveguide core~~.~~,wherein the grating is formed using a laser operating at a wavelength in the range of 150 nm to 400 nm through a phase mask deposited on top of said upper cladding layer of the waveguide.

77. A method as claimed in ~~any of~~ Claim~~s~~ 72~~-to 74~~, wherein the grating is formed using a using an interference side writing technique.

78. A method as claimed in ~~any of~~ Claim~~s~~ 72~~-to 74~~, wherein the grating is formed using a direct writing technique.

Please cancel claims 6, 7, 15, 18, 19, 27, 34, 35, 37, 38, 40, 41, 44-49, 52, 56, 60, 61, 64, 68, 73-76, 79-85.